

Practitioners' use of life cycle costing with environmental costs—a Swedish study

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Abstract

Purpose The aim of this paper is to describe life cycle costing (LCC) practices in some Swedish organisations, investigate probable changes and determine whether and how environmental costs (internal and/or external) are considered in current LCC.

Methods This paper is based on interviews with LCC practitioners working in authorities and companies in Sweden, mainly the Swedish defence sector, but also other sectors to broaden the study.

Results and discussion Those interviewees who use LCC all employ their own particular method, adjusted from case to case. Inclusion of future costs and use of interest rate is also decided from case to case.

Conclusions The inclusion of direct, indirect, contingent and intangible costs differs between organisations. Even when environmental costs are considered in the LCC, not all the internal (environmental) costs are included. All interviewees believe that LCC can be important for decision making and most also believe that environmental costs, like other costs, influence final decisions, but still LCC is not always performed or used. The companies represented are large, and a particular individual cannot have insights into all methods or procedures used in different departments. The results are thus based upon interviews with individuals representing the companies and the responses might have been different if different individuals had been interviewed. However, since the

answers between the different time periods and between the organisations point in the same direction, we found no need to make further interviews.

Keywords Environmental costs · LCC · Life cycle costing · Practitioner use

1 Introduction

The importance of a life cycle perspective in decision making and inclusion of environmental costs in life cycle costing (LCC) has been stressed by a number of sectors and actors, such as the defence sector (SAF 2003; Tysseland 2008), the housing sector (Sundkvist et al. 2006), product development (COM 2008, 397) and green procurement within the EU (PricewaterhouseCoopers 2009; EU Directive 2009/33/EC). One argument for including external costs is the polluter pays principle, which is accepted policy within the European Union (Hunkeler et al. 2008). However, according to current legislation governing public organisations in the European Union, external costs are not included in the award criteria for public procurement purposes, since these costs are not borne by the procuring organisation (COM 2001, 274). There are currently different explanations of environmental costs and different LCC approaches including environmental costs. Hunkeler et al. (2008) divide LCC into conventional, environmental or societal. Conventional LCC is a collection of all costs associated with the life cycle of a product that are directly covered by any one or more of the actors in the product life cycle. Environmental LCC, on the other hand, also includes external costs that might be internalised within a foreseeable time frame. With this definition, environmental LCC could be developed in a similar way to life cycle

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assessment (LCA). Societal LCC is even broader, including costs for society overall. Environmental costs are defined as either environmental damage expressed in monetary terms (costs of external effects), or as the market-based cost of measures to prevent environmental damage (Hunkeler et al. 2008). Another way of defining environmental costs is to divide them into different types, as in Norris (2001) and CWRT (2000). These are direct (e.g. costs for waste disposal and raw material), indirect (e.g. costs for environmental management systems), contingent (e.g. fines), intangible (e.g. goodwill or badwill) and external costs (costs borne by parties other than the company, e.g. the society). Direct, indirect, contingent and intangible costs are borne by the company and, according to the definitions above, should be included in conventional LCC, while external costs should be omitted.

There are examples of conventional LCC with additional environmental costs in the literature (see e.g. CWRT 2000; Senthil et al. 2003; Bengtsson and Sjöberg 2004), and LCC combined with LCAs (see e.g. Carlsson Reich 2005; Kicherer et al. 2007). Direct and indirect costs are covered in all of these LCC models, and sometimes also contingent costs. In the approach described by Bengtsson and Sjöberg (2004) intangible costs are also included in the form of membership of special interest organisations. In CWRT (2000), all the cost types, including external costs, are examined. In the LCC–LCA combinations, external costs are also included.

Use of LCC in Swedish organisations has been studied previously, e.g. by Sterner (2000). That study revealed that the most common computer models at the time were Excel-based, and that only 6% of the organisations studied included environmental costs associated with demolition and disposal fees. LCC was usually performed in the design phase of projects, by the company itself or by a consultant. Cost parameters usually included were investment costs, energy costs and maintenance costs. The two main constraints for adopting LCC were identified as lack of experience and lack of significant data (ibid.). The use of LCC in the decision-making process is interesting. Gluch and Baumann (2004) describe some of the difficulties with so many alternatives for integrating LCC and environmental performance as well as the shortcomings of LCC for environmental decision making. Among the identified shortcomings by ibid. are the lack of reliable data, that LCC fails to handle irreversible decisions and decisions under uncertainty, and that LCC neglects items that have no owner. In order to improve the use of LCC for decision making, they inquire further research concerning such tools as well as a common conceptualisation, an inclusion of physical measures in LCC tools and a better understanding for such tools and their applicability.

The aim of this paper is to describe LCC practices in some Swedish organisations, investigate probable changes

and determine whether and how environmental costs (internal and/or external) are considered in current LCC. The results will contribute to the understanding of use of tools for environmental decision making.

2 Methods

The paper is based on a number of interviews with potential or current LCC practitioners in Sweden. The interviews were carried out in two periods, 2005–2006 and 2010. When necessary, interviews from the earlier period were updated. The method involved open-ended questions in semi-structured interviews and the use of questionnaires (here both referred to as interviews). This approach was chosen because it provided the scope to include answers from more interviewees. The interviewees came from sectors with a tradition of using LCC and the interviewees themselves were familiar with LCC, either as a concept or as LCC practitioners or users of LCC results. All interviewees were based in Sweden and were working in: two real estate companies (A and B); two manufacturing companies (C and D); three companies within the vehicle industry (E, F, G); a company working with end-of-life costs for suppliers and procurers (H); three authorities in the Swedish defence sector; and the Swedish Transport Administration (formerly Swedish Rail Administration). The private companies are anonymous, since this was a request from one of the interviewees. A total of 13 semi-structured interviewees were held, questionnaires were sent to 12 persons and seven answers were received. Responses were analysed according to a method for concentrating sentences described in Kvale (1997), and all interviewees were given the opportunity to approve their statements in printed form.

The questions raised in interviews concerned the LCC method used, whether environmental costs are considered, the purpose of the LCC, the use of the results and the importance of the results for decision making.

3 Results

The answers obtained in interviews are presented in Table 1 and discussed below.

3.1 User, performer and purpose of the LCC

The reasons for actors performing and using LCC differ between the organisations represented. In some cases, the intention is to perform LCC within the organisation for use by customers, while in other cases LCC is performed for internal use, by consultants or internal personnel. For

Table 1 LCC methods used, environmental costs included and purpose and use of LCC

Organisation	LCC method	Environmental costs	Purpose and use of LCC
Real estate company A	Company-specific (a computer programme has been developed) or consultant's model	'All costs related to the project', but environmental costs not explicitly stated	Used by project leaders and consultants as a basis for decisions on major investments
Real estate company B	Other methods for cost estimations	-	-
Manufacturing company C	Company-specific, Excel-based	Direct, indirect and contingent, but environmental costs not explicitly stated	Performed by company, used by salesmen as sales arguments
Manufacturing company D	Different models, mostly Excel-based	'Costs related to the supplier's responsibility', no external costs. Environmental costs not explicitly stated	Performed by the company, used by customers to guide their choices
Vehicle industry E	Other methods for cost estimations	No external costs	Cost estimations, for internal and external comparisons
Vehicle industry F	Other methods for cost estimations are used	No	Unclear
Vehicle industry G	Yes	External, in particular CO ₂ costs, methods from other research institutes such as EPS. There is a risk of external costs being internalised, important to show this. For EU-funded research projects, to show the societal benefits.	Most often for public procurement organisations, mostly for research purposes
Company H	Company-specific	Only end-of-life costs	Performed by the company, used by customers to provide end-of-life costs for investors
The Swedish Transport Administration (formerly Swedish Rail Administration)	Different models	Direct, indirect, contingent. Environmental costs not explicitly stated	Used within the company, as a basis for decisions on major investments
The Swedish defence sector	Company-specific, Excel-based or a specific computer programme	Direct, indirect, contingent. In the process of developing a method including external costs	Performed and used by different organisations, for procurement

example, in the defence sector, LCC is carried out by the procurement organisation, the Swedish Defence Materiel Administration (FMV), sometimes with the help of a consultant, and is used as a basis for evaluating alternatives at FMV, or as a basis for planning in the Swedish Armed Forces. The reasons mentioned by the interviewees for not using LCC are that it is difficult and complicated, too time-consuming, too expensive, that it is difficult to see advantages with the method, the project is too small or that the product is already known and thereby does not need to be evaluated. Some of the companies in the Swedish transport industry do not use LCC at all, and instead, they examine costs using other methods (such as pay-off methods). The mentioned reasons behind this were to use methods that are traditionally used at the company or to calculate the payoff of the investment. For example, one company is responding to an external demand from customers to present LCCs for the product or service sold. In another case, the reason is to show that procurement organisations, mainly public, are saving money for the society by making certain investments. Others meet no external demand at all.

3.2 LCC method

All interviewees using LCC employ a more or less company-specific method, adjusted from case to case, for example inclusion of future costs and use of interest rate is also decided from case to case. One reason mentioned for why adjustments were made was the customer demand. In one company, only end-of-life costs are considered, and no full LCC is made. Another company is in the process of developing a model, but did not use LCC at the time of interview. LCC can be performed using pen and paper, or using a specific computer programme. However, most models used by the interviewees are Excel-based. In the defence sector, no interest rate is used in the LCC. One explanation is that LCC is used to compare suppliers and not to generate exact numbers. Another reason is that FMV cannot save money from 1 year to the next (Nordlund et al. 2005). In some cases, the LCC only includes costs relevant for the customer, i.e. the life cycle is interpreted as a limited economic life.

3.3 Environmental costs

Some interviews show that environmental costs (internal or external) are not explicitly included. Most cases when environmental costs are included are when the customer is a public procurement organisation or when the customer explicitly demands it. Even when internal environmental costs are included in the LCC, not all of them are included. For example, at FMV not even end-of-life costs are

normally included. Within the Swedish transport industry, the interest in environmental issues differs greatly. Some perform simplified LCA and some even include external costs in LCC. On the other hand, some companies scarcely consider environmental impacts at all.

3.4 Importance for decision

Even though many interviewees believed that LCC can be important for decision making, LCC was not always performed or used. Some use other tools for cost estimations (such as payoff) instead and find them adequate. Most of the interviewees believed that environmental costs, just like other costs, have an influence on the final decision. One interviewee emphasised the importance of environmental impacts being allocated a cost, since if an impact has no given costs, it is less likely to influence the final decision. Another interviewee believed that environmental issues are often regarded as complicated and expensive. Therefore, it would be an advantage if environmental costs were included in the basis for decision making. Although many of the interviewees emphasised the importance of expressing environmental impacts in monetary terms, they questioned whether including environmental costs in LCC was the best way to achieve this. They believe that an LCC has an influence on the decision it is intended to support, with the restriction that the study is properly carried out.

4 Discussion and conclusions

Common practice appears to be the use of a company-specific LCC model, if LCC is used at all. Since the costs included and discount rates differ between models, results from different studies are not comparable or easily communicated to people other than those familiar with the specific LCC model. This implies that results from different LCCs are not comparable or easily communicated to people other than those familiar with the specific LCC model. This could be a problem, for example when a procurement organisation is comparing alternatives on the basis of LCC made by different suppliers.

The inclusion of direct, indirect, contingent or intangible costs differs greatly between the organisations represented by the interviewees. Whether intangible costs should be included or not can be the subject of future research. Public organisations have not been allowed to include external costs when evaluating tenders, but they can be taken into account when defining the subject matter of a contract. With the EU Directive (2009/33/EC), there is a possibility to include external costs when evaluating tenders for the transport sector. If the LCC is to be used to estimate environmental costs in a broader sense, i.e. with the same

system boundaries as in LCA or for society, inclusion of external costs would probably be relevant.

Even though most of the interviewees believed that LCC, including environmental costs, can be important for decision making, LCC is not always performed or used. The reasons mentioned by the interviewees for not using LCC are that it is difficult and complicated, too time-consuming, too expensive, that other methods are used and difficulties with public purchasing rules.

For integrating LCC into the decision-making process, there is a need for a common framework for LCC or a model that is easily used. There is also a need for an initiative to use LCC and environmental LCC. It is possible that the EU Directive could serve as such an initiative. For including environmental costs, there is also a need for available data on environmental costs that can be used in the LCC. Within the public organisations, the procurement rules where defined as an obstacle for including environmental costs in LCC. On the other hand, for the private organisations not covered by the rules, the obstacle for using LCCs or environmental LCCs was rather the tradition of using company-specific methods. If LCC is to be used, there is a need to explore aspects that facilitate the use of LCC within the decision-making process. It would be interesting to further investigate how the use of LCC is implemented in the decision-making process and the effectiveness of policy instruments. Further research is also needed to provide available data on environmental impacts and monetary weighting.

One diverging concept found is from the defence sector. No discounting rate is used in FMV's current LCC. Since LCC is used to model costs during a time series, this practice could be questioned. The reason for not discounting did not become clear during the interviews, but it could be because money cannot be transferred from 1 year to the next. However, since the government, which controls procurement, can save money between years, discounting could still be relevant. To allow alternatives to be compared fairly, the present value of future costs or revenues needs to be calculated. The motives for discounting (and if so, the rate) need clarification, and should be the subject of future research.

It should be borne in mind that these results are based upon interviews with individuals representing large companies and that the responses might have been different if different individuals had been interviewed. The companies represented are large and a particular individual cannot have insights into all methods or procedures used in different departments. However, since the answers between the different time periods and between the organisations point in the same direction, we found no need to make further interviews.

The use and opinion of LCC seems not to have changed substantially during recent years. Some companies are

using it, while others are using other methods (such as pay-off methods) or find it too complicated to use it at all. Among those using it, environmental costs are not always included. A reason for this may be lack of uniform (environmental) LCC methods or purchasing procedures.

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